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PHYSICS

THE NYU LIBRARY OF SUBROUTINES

by

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CONTRACT NO. AT(30-1)-1480

January 1, 1956

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INTRODUCTION

A set of subroutines has been developed at the AEC Computing Facility at New York University for evaluating simple functions and for performing certain standard procedures. Detailed descriptions of the routines are available, and a library tape containing the routines is kept at the Univac. The routines are written to be compatible with the NYU Compiler System (NYO-6478). The number of routines is contantly being increased and the routines themselves may be modified from time to time on the basis of experience in applying them to various problems. The list presented here includes those routines currently in use, together with a brief description of each. A revised index of current routines will be issued at intervals, but before using any of the routines the programmer should check the library subroutine book near the computer for the latest corrections and modifications.

INDEX

F.D.C. indicates floating decimal composed arithmetic.
F.D.D. " " " decomposed " .
F.P. " fixed point arithmetic.

ARITHMETIC ROUTINES

Interpretive Floating Decimal Routine P-550106
(AF0016 000000)
A routine to interpret successive lines of three-address instructions as composed floating decimal operations.

Composed Floating Decimal P-551108
(CD0060 000000)
A one-block routine for performing addition, multiplication, division and composition of numbers expressed in composed floating decimal form.

Floating Point Arithmetic P-550511
(FP0120 MAR550)
A routine similar to the commonly used floating decimal routine, FR, save that it is speeded up by eliminating intermediate composition of numbers, and is shorted to the extent that fewer R instructions need be coded.

Floating Decimal Routine P-550404
(FR0120 000000)
This is the floating point routine which has been in use the longest at NYU. The designations F.D.C. (Floating Decimal Composed) and F.D.D. (Floating Decimal Decomposed) in parentheses after other subroutines imply that FR must be compiled into lines 880 and following.

Complex Number Arithmetic (F.D.C.)

P-551107

(CE0060 00000Δ)

Addition, subtraction, multiplication, and division of complex numbers.

Complex Number Arithmetic (F.P.)

P-551106

(CX0060 00000Δ)

Addition, multiplication, and division of complex numbers.

BLOCK OUTPUT ROUTINES

Block Output

P-550109

(BL0010 BLOCKΔ)

On each entrance to this routine the quantity in rA is stored at the next available location in a specified output block. When the output block is filled it is written on a designated tape.

Block Output (V-register)

P-550108

(BV0010 BLOCKΔ)

A routine similar to BL except that the block is filled by pairs of quantities from rV.

DEBUGGING ROUTINES

Generator for Debugging Tape

P-560104

(GR0180 00000Δ)

A routine to generate a requested debugging routine into available blocks of storage in a subject program.

Debugging Routine P-550510
(DB0060 000000)
A routine to perform automatic storage dumps (17 blocks onto tape) or to give automatic register and storage type-outs.

Storage Dump Routines P-550829
(DS0008 0000)
(DP0026 000000)
DS dumps 17 blocks of storage onto servo Δ. DP preserves the contents of registers, dumps a selected region of storage onto a selected servo, and restores the registers.

Q,T,U Tracer - SC typewriter output P-560105
(TR0060 000000)
A routine to monitor a subject program, recording the transfer instructions as they are executed.

Q,T,U Tracer - tape output P-560106
(TE0229 000000)
A routine similar to the above TR.

Tracer Counter P-560107
(TC0120 000000)
A routine to monitor a subject program, recording the changes effected on certain given line locations.

rA Monitor - SC typewriter output P-560108
(MN0102 000000)
A routine to monitor a subject program, recording the changes effected on the A register.

rA Monitor - tape output P-560109
(ME0119 00000/)
A routine similar to the above MN.

Follower P-540729-2
(FL0120 00000/)
A compilable version of the NYU service routine called Follower.

DIFFERENTIAL EQUATION ROUTINES

Differential Equation Solution (F.P.) P-540810
(DY0062 GILLO/)
Integration of a system of ordinary differential equations using the Runge-Kutta-Gill method.

Differential Equation Solution P-550512
(DF0069 FLOAT/)
Integration of a system of ordinary differential equations using the Runge-Kutta-Gill method. The arithmetic is floating decimal requiring use of routine F.P.

EDIT ROUTINES

Sign Edit P-540830
(EA0007 +SIGN/)
A routine to prefix a positive number with a plus sign in place of the Univac zero.

Edit Floating Decimal Composed Number P-550104
(EB0034 EDITΔ/)
A routine to edit a composed floating point number into two words--a signed mantissa with decimal point and a signed base 10 exponent.

Edit Floating Decimal Decomposed Number P-550110
(EP0035 EDITΔ1̸)
A routine to edit a decomposed floating point number into a signed mantissa with decimal point and a signed base 10 exponent.

EXPONENTIALS AND ROOTS

A^x (F.P.) P-550414
(AX0032 000001̸)
A routine to evaluate A^x for

$$0 \le A \le 1$$
$$0 \le x \le 1 .$$

10^x (F.D.C.) P-550416
(LH0040 EXP101̸)
A routine to evaluate 10^x for $|x| < 50$ with error $\pm .00008 \ 10^k$ (k = fractional part of $|x|$).

e^x (F.D.D.) P-540621
(LP0052 EXP001̸)

e^x (F.P.)(x non-positive) P-540622
(LT0033 P001̸)

Square Root (F.D.C.) P-540605
(NA0024 ROOT21̸)

Square Root (F.D.D) P-540603
(NJ0023 ROOT21̸)

Square Root (F.P.) P-540601
(NS0012 ROOT21̸)

Integral Root: $A^{1/p}$ P-550426
(NX0034 ΔpΔ.T1̸)
$|A| < 1; \ p \ge 2$
(Newton-Raphson iterative procedure.)

FILL ROUTINES

Line Fill Routine P-540604

(F()000() ΔFILLi̸)

A set of routines which can be used in compiling to fill from one to nine lines with zeros.

IGNORE SQUEEZE ROUTINES

Ignore Squeeze Block Output P-550329

(GN0057 00000i̸)

On each entrance to this routine the ignores are removed from the word in rA and the result is stored into an output block. (Faster than routine IG.)

Ignore Squeeze Block Output P-551105

(IG0034 00000i̸)

Same as routine GN in purpose but shorter in space.

INTEGRATION ROUTINES

Integration: Simpson's Rule (F.D.D.) P-540607

(QN0050 00000i̸)

A routine to evaluate $\int_a^b f(x)dx$

given a, b, the interval of integration and a routine for f(x).

Integration: Gauss's Method (F.D.D.) P-550506

(GM0036 00000i̸)

Evaluation of an integral using Gauss's method (integrand evaluated at unequal intervals) of order n ($4 \leq n \leq 10$).

Integration: Gauss's Method (F.P.) P-550505
(GS0025 000001̸)
Fixed point version of the above routine, GM.

G4 ··· through G- are the routines containing the coefficients for GM and GS.

INTERPOLATION ROUTINES

Interpolation (F.D.D.) P-540811
(IP0062 AITK.1̸)
A routine to perform interpolation of order n using Aitken's method (restricted to equal intervals).

Lagrange Interpolation (F.D.D.) P-540624
(IL0069 000001̸)
A routine to perform interpolation of order n using Lagrange's formula (unequal intervals).

LOGARITHM ROUTINES

Natural Logarithm (F.D.C.) P-550830
(LF0044 LN0001̸)

Logarithm to Base 10 $\left(\begin{smallmatrix}\text{F.D.C.}\\ \text{F.D.D.}\end{smallmatrix}\right)$ P-550415
(LN0022 LOG101̸)
A routine to find $\log_{10}x$ with $|\text{error}| < .0007$.

Logarithm to Base 2 (F.D.C.) P-540702
(LJ0040 BASE21̸)

Logarithm to Base 2 (F.P.) P-540712
(LX0043 BASE 21̸)

POLYNOMIAL ROUTINES

Polynomial Evaluation (F.P.) P-540606

(PS0018 00000i̸)

A routine to evaluate $\sum_{j=0}^{n} a_j x^j$ given n, the a_j's and x.

SORTING ROUTINES

Sorting Routine P-550827

(ST0032 SORTΔi̸)

A routine to sort Univac words (numbers and/or letters) into a sequence of increasing magnitude. Up to 968 words may be sorted.

TRIGONOMETRIC ROUTINES

Sine-Cosine (F.D.C.) P-550107

(TD0052 COSSNi̸)

Sine-Cosine (F.D.D.) P-550105

(TK0054 COSSNi̸)

Sine-Cosine (F.P.) P-550413

(TV0041 00000i̸)

$\text{Tan}^{-1}x$ (F.P.) P-550902

(TY0057 00000i̸)

Continued fraction approximation, error $< 10^{-10}$

$\text{Tan}^{-1}x$ (F.P.) P-550901

(TZ0025 00000i̸)

Polynomial approximation, error $\sim 10^{-8}$.

(Faster but less accurate than TY)

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